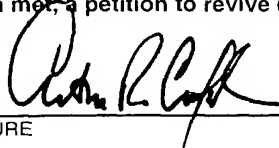


FORM PTO-1390 (REV 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER 978-57
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371			U.S. APPLICATION NO. (If known, see 37 C.F.R. 1.5) 10/089438 Unknown
INTERNATIONAL APPLICATION NO. PCT/GB00/03718	INTERNATIONAL FILING DATE 28/09/2000	PRIORITY DATE CLAIMED 29/09/1999	
TITLE OF INVENTION GEAR BOX MECHANISM			
APPLICANT(S) FOR DO/EO/US MEPHAM, S. et al.			
Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:			
<ol style="list-style-type: none"> 1. <input checked="" type="checkbox"/> This is a FIRST submission of items concerning a filing under 35 U.S.C. 371. 2. <input type="checkbox"/> This is a SECOND or SUBSEQUENT submission of items concerning a filing under 35 U.S.C. 371. 3. <input checked="" type="checkbox"/> This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (21) indicated below. 4. <input type="checkbox"/> The U.S. has been elected by the expiration of 19 months from the priority date (Article 31). 5. A copy of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto (required only if not communicated by the International Bureau). b. <input checked="" type="checkbox"/> has been communicated by the International Bureau c. <input type="checkbox"/> is not required, as the application was filed in the United States Receiving Office (RO/US). 6. <input type="checkbox"/> An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)). <ol style="list-style-type: none"> a. <input type="checkbox"/> is attached hereto. b. <input type="checkbox"/> has been previously submitted under 35 U.S.C. 154(d)(4). 7. <input type="checkbox"/> Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3)) <ol style="list-style-type: none"> a. <input type="checkbox"/> are attached hereto (required only if not communicated by the International Bureau). b. <input type="checkbox"/> have been communicated by the International Bureau. c. <input type="checkbox"/> have not been made; however, the time limit for making such amendments has NOT expired. d. <input type="checkbox"/> have not been made and will not be made. 8. <input type="checkbox"/> An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)). 9. <input type="checkbox"/> An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)). 10. <input type="checkbox"/> A English language translation of the annexes of the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)). 			
Items 11 To 20 below concern document(s) or information included:			
<ol style="list-style-type: none"> 11. <input type="checkbox"/> An Information Disclosure Statement under 37 C.F.R. 1.97 and 1.98. 12. <input type="checkbox"/> An assignment document for recording. A separate cover sheet in compliance with 37 C.F.R. 3.28 and 3.31 is included. 13. <input checked="" type="checkbox"/> A FIRST preliminary amendment. 14. <input type="checkbox"/> A SECOND or SUBSEQUENT preliminary amendment. 15. <input type="checkbox"/> A substitute specification. 16. <input type="checkbox"/> A change of power of attorney and/or address letter. 17. <input type="checkbox"/> A computer-readable form of the sequence listing in accordance with PCT Rule 13ter 2 and 35 U.S.C. 1.821-1.825. 18. <input type="checkbox"/> A second copy of the published international application under 35 U.S.C. 154(d)(4). 19. <input type="checkbox"/> A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4). 20. <input checked="" type="checkbox"/> Other items or information PTO Form 1449 			

U.S. APPLICATION NO (If known, see 37 C.F.R. 1.51) unknown 10/089438		INTERNATIONAL APPLICATION NO PCT/GB00/03718		ATTORNEY'S DOCKET NUMBER 978-57							
21. <input checked="" type="checkbox"/> The following fees are submitted:				CALCULATIONS PTO USE ONLY							
BASIC NATIONAL FEE (37 C.F.R. 1.492(a)(1)-(5): -- Neither international preliminary examination fee (37 C.F.R. 1.482) nor international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO\$1040.00 -- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO.....\$890.00 -- International preliminary examination fee (37 C.F.R. 1.482) not paid to USPTO but international search fee (37 C.F.R. 1.445(a)(2)) paid to USPTO\$740.00 -- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4).....\$710.00 -- International preliminary examination fee (37 C.F.R. 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4).....\$100.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				<table border="1" style="width:100%; border-collapse: collapse;"> <tr> <td style="width:10%; text-align: right;">\$</td> <td style="width:70%; text-align: right;">890.00</td> <td style="width:20%;"></td> </tr> <tr> <td style="text-align: right;">\$</td> <td style="text-align: right;">130.00</td> <td></td> </tr> </table>		\$	890.00		\$	130.00	
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Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input checked="" type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(e)).											
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE								
Total Claims	20	-20 =	0	X	\$18.00						
Independent Claims	2	-3 =	0	X	\$84.00						
MULTIPLE DEPENDENT CLAIMS(S) (if applicable)					\$280.00						
CLAIM FEES ARE NOT BEING PAID AT THIS TIME				TOTAL OF ABOVE CALCULATIONS =							
<input type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27. The fees indicated above are reduced by 1/2.					\$ 0.00						
SUBTOTAL =					\$ 1020.00						
Processing fee of \$130.00, for furnishing the English Translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 C.F.R. 1.492(f)).					\$ 0.00						
TOTAL NATIONAL FEE =					\$ 1020.00						
Fee for recording the enclosed assignment (37 C.F.R. 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 C.F.R. 3.28, 3.31). \$40.00 per property					\$ 0.00						
Fee for Petition to Revive Unintentionally Abandoned Application (\$1280.00 - Small Entity = \$640.00)					\$ 0.00						
TOTAL FEES ENCLOSED =					\$ 1020.00						
				Amount to be: refunded	\$						
				Charged	\$						
a. <input checked="" type="checkbox"/> A check in the amount of \$1020.00 to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. 14-1140 in the amount of \$_____ to cover the above fees. A duplicate copy of this form is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 14-1140. A duplicate copy of this form is enclosed. d. <input checked="" type="checkbox"/> The entire content of the foreign application(s), referred to in this application is/are hereby incorporated by reference in this application.											
NOTE: Where an appropriate time limit under 37 C.F.R. 1.494 or 1.495 has not been met, a petition to revive (37 C.F.R. 1.137(a) or (b)) must be filed and granted to restore the application to pending status.											
SEND ALL CORRESPONDENCE TO: NIXON & VANDERHYE P.C. 1100 North Glebe Road, 8 th Floor Arlington, Virginia 22201-4714 Telephone: (703) 816-4000			<div style="text-align: center;">  SIGNATURE </div> <div style="text-align: center;"> Arthur R. Crawford NAME </div> <div style="display: flex; justify-content: space-between;"> <div> 25,327 REGISTRATION NUMBER </div> <div> March 29, 2002 Date </div> </div>								

10/089438

JC10 Rec'd PCT/PTO 29 MAR 2002

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Patent Application of

MEPHAM, S. et al.

Atty. Ref.: 978-57

Serial No. unknown

Group:

Filed: March 29, 2002

Examiner:

For: GEAR BOX MECHANISM

* * * * *

March 29, 2002

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

PRELIMINARY AMENDMENT

In order to place the above-identified application in better condition for examination, please amend the application as follows:

IN THE SPECIFICATION

Please substitute the following paragraphs in the specification for corresponding paragraphs previously presented. A copy of the amended specification paragraphs showing current revisions is attached.

Page 1, before the first line, insert as a separate paragraph:

This application is the US national phase of international application PCT/GB00/03718 filed 28 September 2000, which designated the US.

IN THE CLAIMS

Please substitute the following amended claims for corresponding claims previously presented. A copy of the amended claims showing current revisions is attached.

5. A gear change mechanism according to claim 1 wherein the cylinder means, shaft and piston means provide four chambers within the cylinder means and each chamber is connectable to a source of pressure fluid, connection being selectable to effect movement of the shaft to any one of said positions.

8. A gear change mechanism according to claim 5 comprising inlet means for admitting pressure fluid to said chambers fluid being admitted to said first pair of chambers to locate said shaft in an intermediate position. fluid being admitted to one of said second pair of chambers to move the shaft towards one or other end of the cylinder means.

9. A gear change mechanism according to claim 5 comprising two fluid control valves selectively operable to admit fluid to the chambers and thereby move the shaft towards one of the end positions, or to the intermediate position.

14. A gear change mechanism according to claim 6, wherein the annular pistons are each located about an associated, reduced-section portion of the shaft, and

MEPHAM, S. et al.
Serial No. **unknown**

each piston is movable axially of the shaft in limited extent which is defined by the length of the reduced-section portion.

16. A gear change mechanism according to claim 1 wherein the shaft is movable towards one end of the cylinder means by the admission of fluid to one of the pair of first chambers situated at the opposite end of the shaft to said one end, to provide two end positions of the shaft.

18. A gear change mechanism according to claim 6 wherein the shaft is movable towards one of said two intermediate positions by admitting fluid to both said first chambers.

20. A gear change mechanism according to claim 10 wherein two fluid control valves control the movement of the shaft to the end positions and the two intermediate positions.

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REMARKS

Attached hereto is a marked-up version of the changes made to the specification and claims by the current amendment. The attached page(s) is captioned "**Version With Markings To Show Changes Made.**"

Respectfully submitted,

NIXON & VANDERHYE P.C.

By: _____



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VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE SPECIFICATION

Page 1, before the first line, insert as a separate paragraph:

This application is the US national phase of international application PCT/GB00/03718 filed 28 September 2000, which designated the US.

IN THE CLAIMS

5. A gear change mechanism according to ~~any one of the preceding claims~~ 1 wherein the cylinder means, shaft and piston means provide four chambers within the cylinder means and each chamber is connectable to a source of pressure fluid, connection being selectable to effect movement of the shaft to any one of said positions.

8. A gear change mechanism according to ~~any one of claims 5, 6 or 7~~ comprising inlet means for admitting pressure fluid to said chambers fluid being admitted to said first pair of chambers to locate said shaft in an intermediate position. fluid being admitted to one of said second pair of chambers to move the shaft towards one or other end of the cylinder means.

9. A gear change mechanism according to ~~any one of the claims 5 to 8~~ comprising two fluid control valves selectively operable to admit fluid to the chambers and thereby move the shaft towards one of the end positions, or to the intermediate position.

14. A gear change mechanism according to ~~any one of claims 6, 7, 11, 12 or 13~~ wherein the annular pistons are each located about an associated, reduced-section portion of the shaft, and each piston is movable axially of the shaft in limited extent which is defined by the length of the reduced-section portion.

16. A gear change mechanism according to ~~any one of claims 1 to 15~~ wherein the shaft is movable towards one end of the cylinder means by the admission of fluid to one of the pair of first chambers situated at the opposite end of the shaft to said one end, to provide two end positions of the shaft.

18. A gear change mechanism according to claim 6, ~~12 or 13~~ wherein the shaft is movable towards one of said two intermediate positions by admitting fluid to both said first chambers.

20. A gear change mechanism according to ~~any one of claims 10 to 19~~ wherein two fluid control valves control the movement of the shaft to the end positions and the two intermediate positions.

Gear Box Mechanism

The present invention relates to a gear change mechanism and particularly, but not exclusively, to a gear change mechanism for effecting a gear change in a gearbox of a vehicle.

The present invention aims to provide an improved gear change mechanism.

Accordingly, there is provided in one aspect a gear change mechanism for a gear box in which changes of gear ratio in the gearbox are made mechanically in response to actuating signals.

the mechanism including first and second actuator assemblies each connected to a gearbox gear change selector,

the selector being movable about an axis and in the direction of said axis to a plurality of positions for effecting changes of gear in the gearbox,

the first actuator assembly being arranged to move the selector in said axial direction between a plurality of axial positions,

the second actuator assembly being arranged to move a gear change selector about said axis between a plurality of rotational positions,

each of the first and second actuator assemblies including cylinder means, a shaft located in the cylinder means and drivingly connected to the selector, and piston means located about said shaft,

in each case the cylinder means, shaft and piston means together define chambers into which pressure fluid is selectively introduced so that the shaft is movable to at least three positions.

Preferably, a gear change mechanism is provided wherein the three positions of the shaft of each actuator assembly include two end positions and a position intermediate the ends.

Preferably, the or each cylinder means is divided into four chambers, each chamber being defined by one of said annular pistons and a respective portion of the cylinder means and said chambers are arranged to be selectively supplied with pressure fluid thereby to move said shaft relative to the cylinder.

5

Said pressure fluid may be pressurised hydraulic fluid or may be pneumatic fluid e.g. air. Alternatively, said first two of said chambers may be supplied with pressurised air and said second two of said chambers may be supplied with pressurised hydraulic fluid.

10

According to a second aspect of the present invention, there is provided a gear change mechanism for a gearbox in which changes of the gear ratio in the gearbox are made mechanically in response to actuating signals,

the mechanism including first and second actuator assemblies each connectable to a gearbox gear change selector, the gear change selector being rotatable about an axis and being movable in the direction of said axis to a plurality of positions for effecting changes of gear ratio in the gearbox,

the first actuator assembly including cylinder means and a shaft, the shaft being movable relative to the cylinder means between end positions and an intermediate position between the ends, to rotate the selector about its axis,

a second actuator assembly including cylinder means and a shaft, the shaft being movable relative to the cylinder means between the opposite end positions and two positions intermediate its ends, thereby to move the selector to any one of four positions in its direction along said axis.

25

The present invention will now be described, by way of example only, with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of a housing of preferred form of gear change mechanism according to the invention;

30

Fig. 2 is a perspective view of a preferred form of gear selector mechanism according to the invention;

5 Fig. 3 is a section through the gear change mechanism of Fig. 1 on the line A-A showing a first actuator assembly in a left-most position;

Fig. 4 is a section through the gear change mechanism of Fig. 1 on the line A-A showing a first actuator assembly in a "middle left" position;

10

Fig. 5 is a section through the gear change mechanism of Fig. 1 on the line A-A showing a first actuator assembly in a "middle right" position;

15

Fig. 6 is a section through the gear change mechanism of Fig. 1 on the line A-A showing a first actuator assembly in a right-most position;

Fig. 7 is a section through the gear change mechanism of Fig. 1 on the line B-B showing a second actuator assembly in a central position;

20

Fig. 8 is a section through the gear change mechanism of Fig. 1 on the line B-B showing a second actuator assembly in a left-most position; and

Fig. 9 is a section through the gear change mechanism of Fig. 1 on the line B-B showing a second actuator assembly in a right-most position.

25

Referring to Fig. 1, a preferred form of gear change mechanism according to the invention is shown generally at 10. The mechanism is intended to be used primarily, but not exclusively, in an automatic or semi-automatic gearbox arrangement of a vehicle whereby gear changes are initiated by control signals

applied to the mechanism which signals may be generated by a computer on the vehicle or manually by the driver of the vehicle.

In this embodiment, the mechanism 10 is powered hydraulically by pressurised fluid through valves such as shown in Fig. 3. The control input signals referred to above are thus used to activate or deactivate selectively the valve assembly thereby to operate the gear change mechanism.

The mechanism 10 includes an outer housing 12 providing ports (not shown) for the introduction and discharge of hydraulic fluid to and from the mechanism. A gear selector mechanism 20, shown in detail in Fig. 2, is disposed within a central portion 14 of the housing 12. The housing 12 also contains a first or left/right actuator assembly 18 and a second or front back actuator assembly 16. The first actuator assembly 18 extends perpendicular to and below the second actuator assembly 16.

The gear selector mechanism 20 has an actuator arm 22, the purpose of which is described below, fixed to a substantially annular hub portion 26. A selector finger 24 is also fixed to the hub 26 diametrically opposed to the actuator arm 22. The hub 26 is mounted on a shaft 28 for sliding movement along the shaft and rotational movement about the axis of the shaft, the shaft being fixed within the housing 12.

The finger 24 is arranged to engage with a conventional gearbox (not shown) in known manner such that movement of the arm in the axial direction of the shaft 28 and rotationally about the shaft causes changes of gear in the gearbox. Specifically, there is shown in Fig. 2 for illustrative purposes a typical gearbox layout L with which the mechanism of the present invention can operate. The layout serves a seven-speed gearbox with four rails being of a so-called "double-H pattern", having gears 1 to 4 in a standard H pattern arrangement, and

Gears 1 and 2 are therefore opposite one another on the first "rail" of the gearbox. gears 3 and 4 are opposite one another on a second rail of the gearbox and gears 5 and 6 and gears 6 and reverse are opposite one another on third and fourth rails of the gearbox respectively, to provide a so-called four-rail gearbox. Other gear arrangements can also be accommodated by the mechanism 10 but the following description is made in relation to the illustrated arrangement.

In this embodiment, for example, gear selection between gears 1 and 2, gears 3 and 4, gears 5 and 6 and gears 7 and reverse requires only rotational movement of the arm 24, while gear selection between gears 2 and 3, gears 4 and 5, gears 6 and 7 requires both rotational movement of the arm 24 to a central neutral position and then movement of the arm 24 in the axial direction of the shaft 28 to the next rail of the gearbox on which the target gear lies.

The drive means for the rotational movement of the gear selector mechanism 20 is achieved by actuator assembly 16, a section through which is shown in Fig. 5 7

to 9. The actuator assembly 16 has a shaft 30 disposed axially within it for limited axial movement therealong.

The shaft 30 comprises two portions 32, 34 (hereinafter referred to as left- and right-portions (32, 34) joined by means of a central portion 36 of greatly reduced diameter, the portions 32, 34 projecting into respective cylinders 31, 35. The presence of the central portion 36 provides a recess 38 in which an upper portion of the actuator arm 22 of the gear selector mechanism 20 is engaged.

The shaft also comprises end portions 40, 42 disposed on the free ends of portions 32 and 34 respectively, the end portions being of slightly reduced diameter compared to portions 30 and 34. The reduced diameter of the end portions provides a shoulder 44, 45 on the left- and right-portions 32, 34 of the shaft respectively. The free ends of each of the end portions 40, 42 has a snubber in the form of a plate 46, 48 of slightly increased diameter.

Each end of each cylinder 31, 35 is provided with a recess 50, 52 being sized to receive the respective snubber 46, 48 on the shaft 30. The shaft 30 is free to move axially within the cylinders such that when the shaft is at its left-most position, Fig. 8, the snubber 46 is seated in the recess 52.

Each end portion of the shaft 40, 42 has a respective annular piston 54, 56 slidably mounted thereon. Each piston is free to slide along the respective end portion of the shaft but its movement is restricted by the shoulder 44, 45 at one end and the snubber 46, 48 at the other end. Relative movement of the pistons within the cylinder is also restricted by the ends of the cylinders and by a respective abutment means in the form of a sealing collar 58, 60 located adjacent the inner ends middle each cylinder.

The sealing collars 58, 60 and the pistons 54, 56 serve to divide the cylinders into four distinct chambers A to D, chamber A being defined between the left end (as depicted in the drawing) of the cylinder 31 and the piston 54, chamber B being defined between the piston 54 and the left-hand sealing collar, chamber C being defined between the right-hand sealing collar and piston 56 and chamber D being defined between the piston 56 and the right-hand end of the cylinder (35).

Each chamber has a respective port to allow pressurised fluid (hydraulic or pneumatic) to enter and/or to be discharged therefrom. In this embodiment, the feeding of fluid to and discharging from chambers A and D is each controlled by valves similar to those shown for the other actuator, as shown in Fig. 3, valves 1 and 2. The left and right sealing collars 58,60 defining respective ends of chambers B and C are arranged to allow trapped air and hydraulic fluid within these chambers to be vented to the gearbox cavity.

Movement of the shaft 30 will now be described. Movement of the shaft to a central position (Fig. 7), causing movement of the gear selector assembly into a neutral position, is achieved by actuating the valves mentioned above in order to supply both chambers A and D with pressurised hydraulic fluid. The pressurised fluid forces the pistons 54 and 56 to move towards each other on the shaft and engage the respective shoulders 44, 45. The shaft takes up into a central position with the pistons abutting with both the shaft shoulders 44, 45 and the sealing collars 58, 60.

The movement of shaft causes the actuator arm 22 of the gear selector mechanism 20, engaged in a recess 38, to rotate to a central position corresponding to neutral in the gearbox.

Movement of the shaft to the left (Fig. 8) is achieved by actuating the valves to cause chamber D only to be supplied with pressurised hydraulic fluid. The shaft

30 moves to the left owing to the pressurised fluid in chamber D until the snubber 46 is seated in the recess 50 in the end of the cylinder 31. During this movement of the shaft, the piston 56 remains in abutment with the right-hand sealing collar and the shaft moves relative thereto until snubber 48 is in abutment with the piston. The left-hand piston 54 remains in contact with shoulder 44 on the shaft but moves to the left relative to the cylinder by virtue of the movement of the shaft.

Movement of the shaft to the left causes the gear selector mechanism to rotate (anticlockwise in the drawing) to cause a gear to be selected in the gearbox.

Movement of the shaft to the right (Fig. 9) is achieved in the reverse manner by supplying chamber A only with hydraulic fluid which forces the shaft to the right and thus causes rotation (clockwise in the drawing) of the gear selector mechanism thus causing a change of gear to be selected.

Movement of the gear selector mechanism 20 in the axial direction of the shaft 28 is achieved by actuator assembly 18, Figs. 3 to 6. The actuator assembly 18 is essentially similar to the actuator assembly 16 but with a number of minor modifications. Firstly, chambers A and D have a portion 70, 72 adjacent the ends of the cylinders 71, 73 having a reduced diameter. This portion of reduced diameter provides abutments 62 and 64 past which the pistons are unable to move. Secondly, the left-hand end portion 40 of the shaft 30 is longer than the right-hand end portion 42 and the right-hand portion 34 of the shaft 30 is longer than the left-hand portion 32. The combined length of the left-hand portion 32 and end portion 40 is substantially similar to the combined length of the left-hand portion 34 and end portion 42. The actuator assembly 18 of Figs. 3 to 6 is arranged to move to four different positions, corresponding to the four rails of a seven-speed gearbox.

From the left-most position, the shaft 30 is moved to a "middle left" position (Fig. 4) in order to move the gear selector assembly to a different rail of the gearbox. This is achieved by supplying pressurised hydraulic fluid simultaneously to chambers A and D such that pistons 54, 56 move towards each other on the shaft and engage the respective shoulders 44, 45. The shaft thus moves into a central position with the pistons abutting with both the shaft shoulders and the sealing collars. Again, the force pushing on the pistons from

chambers B and C is overcome due to the 2:1 piston area ratio of chambers A and D over chambers B and C.

It will be appreciated that this operation is similar to moving the shaft of the first actuator assembly 16 to its middle position. In this case, however, the difference in length of the left portion 32 of the shaft compared with the right portion 34 means that the shaft 30 is moved to a position offset to the left of the central position.

From the middle-left position, the shaft is moved to a middle-right position (Fig. 5) to move the gear selector assembly to the third rail of the gearbox. In this case, both chambers A and D are vented to allow the constant fluid pressure in chambers B and C, supplied by the accumulator, to move the pistons 54, 56 away from each other. Owing to the shorter right-end portion 42 of the shaft 30, the right-hand piston 56 collides with the right snubber 48 before the left-hand piston 54 collides with the left snubber 46 and the shaft 30 is therefore moved to the right. The right-hand piston 56 collides with the narrower portion of chamber D whilst the left piston 54 collides simultaneously with the narrower portion of chamber A and the left-hand snubber 46. The shaft 30 is thus moved to a position slightly offset to the right of centre.

From the middle-right position the shaft is moved to the fully-right position (Fig. 6) in a manner opposite to the movement of the shaft fully to the left. In other words, chamber A is filled with pressurised hydraulic fluid which moves the shaft to the right until the right-hand snubber 48 engages with the right-hand recess 52 in the end of the cylinder. At the fully right position of the shaft, the right-hand piston 56 is trapped between the shoulder 45 on the shaft and the narrower portion of the chamber D whilst the left-hand piston 54 is trapped between the left snubber 46 and the left-hand sealing collar 58. Movement of the shaft to the fully-right position causes movement of the gear selector mechanism

to the last rail on the gearbox. The four positions - left, middle left, middle right and right are generally equally spaced from one another.

It will be appreciated that the three position movement of actuator assembly 16
 5 and the four position movement of actuator assembly 18 allows the selector of
 eight different gears with the centre position of the three position actuator
 assembly representing a neutral gear position. Both of the above described
 actuator assemblies are provided with only two valves which reduces the control
 inputs needed to actuate the gear change. It is quite possible, of course, that
 10 more valves may be used as necessary in order to selectively supply particular
 chambers with pressure fluid and little or no modifications to the gear change
 mechanism are needed to incorporate such alternatives.

While the above embodiment is described in respect of a seven-speed gearbox,
 15 the mechanism may equally be applied to a five-speed gearbox in which case the
 actuator assembly 18 may be replaced by a three-position actuator assembly, the
 same or similar to that of actuator assembly 16. The gear change mechanism
 may be used with any existing gearbox layout.

20 It will be appreciated that the gear change mechanism of the present invention
 allows for a large number of gears to be selected in a gearbox using a minimum
 number of valves or associated control mechanisms. This reduces the control
 inputs required to effect a gear change.

Claims

1. Gear change mechanism for a gear box in which changes of gear ratio in the gearbox are made mechanically in response to actuating signals,

5 the mechanism including first and second actuator assemblies each connected to a gearbox gear change selector,

the selector being movable about an axis and in the direction of said axis to a plurality of positions for effecting changes of gear in the gearbox,

10 the first actuator assembly being arranged to move the selector in said axial direction between a plurality of axial positions,

the second actuator assembly being arranged to move a gear change selector about said axis between a plurality of rotational positions,

15 each of the first and second actuator assemblies including cylinder means, a shaft located in the cylinder means and drivingly connected to the selector, and piston means located about said shaft,

in each case the cylinder means, shaft and piston means together define chambers into which pressure fluid is selectively introduced so that the shaft is movable to at least three positions.

20 2. A gear change mechanism according to claim 1 wherein the three positions of the shaft of each actuator assembly include two end positions and a position intermediate the ends.

25 3. A gear change mechanism according to claim 2 wherein the intermediate position is at substantially equal spacings from the end positions.

4. A gear change mechanism according to claim 1 wherein there are at least two intermediate positions providing at least four positions of the shaft, and the positions are regularly spaced between the end positions.

10. A gear change mechanism for a gearbox in which changes of the gear ratio in the gearbox are made mechanically in response to actuating signals,

the mechanism including first and second actuator assemblies each connectable to a gearbox gear change selector, the gear change selector being rotatable about an axis and being movable in the direction of said axis to a plurality of positions for effecting changes of gear ratio in the gearbox,

5 the first actuator assembly including cylinder means and a shaft, the shaft being movable relative to the cylinder means between end positions and an intermediate position between the ends, to rotate the selector about its axis,

a second actuator assembly including cylinder means and a shaft, the shaft being movable relative to the cylinder means between the opposite end
10 positions and two positions intermediate its ends, thereby to move the selector to any one of four positions in its direction along said axis.

11. A gear change mechanism according to claim 10 wherein the actuator assemblies each include a pair of annular pistons located about the associated
15 shaft and four fluid chambers are defined within the associated cylinder means between the shaft, the annular pistons, and the cylinder means, and each chamber is connectable to a source of pressure fluid.

12. A gear change mechanism according to claim 11 wherein said chambers
20 are arranged to define a first pair of chambers at opposite ends of the cylinder means, each chamber of said first pair being defined by the shaft, one end of one of the pair of annular pistons, and the associated end of the cylinder means.

13. A gear change mechanism according to claim 12 wherein a second pair
25 of chambers is located within the cylinder means and each chamber of the second pair is defined by the shaft, by the opposite end of one of the annular pistons, and by a part of the cylinder means located inwardly of the ends of the cylinder means.

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14. A gear change mechanism according to any one of claims 6, 7, 11, 12 or 13 wherein the annular pistons are each located about an associated, reduced-section portion of the shaft, and each piston is movable axially of the shaft in limited extent which is defined by the length of the reduced-section portion.

15. A gear change mechanism according to claim 14 wherein the length of the reduced-section portions towards each end of the shaft is different.

16. A gear change mechanism according to any one of claims 1 to 15 wherein the shaft is movable towards one end of the cylinder means by the admission of fluid to one of the pair of first chambers situated at the opposite end of the shaft to said one end, to provide two end positions of the shaft.

17. A gear change mechanism according to claim 13 wherein, during operation, there is a constant supply of pressure fluid to both of said second chambers.

18. A gear change mechanism according to claim 6, 12 or 13 wherein the shaft is movable towards one of said two intermediate positions by admitting fluid to both said first chambers.

19. A gear change mechanism according to claims 13 wherein pressure fluid is admitted to both said second chambers and not to either of said first chambers, to move the shaft to the other of said intermediate positions.

20. A gear change mechanism according to any one of claims 10 to 19 wherein two fluid control valves control the movement of the shaft to the end positions and the two intermediate positions.

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
5 April 2001 (05.04.2001)

PCT

(10) International Publication Number
WO 01/23786 A1

(51) International Patent Classification⁷: **F16H 61/30**

(21) International Application Number: PCT/GB00/03718

(22) International Filing Date:
28 September 2000 (28.09.2000)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
9922875.1 29 September 1999 (29.09.1999) GB

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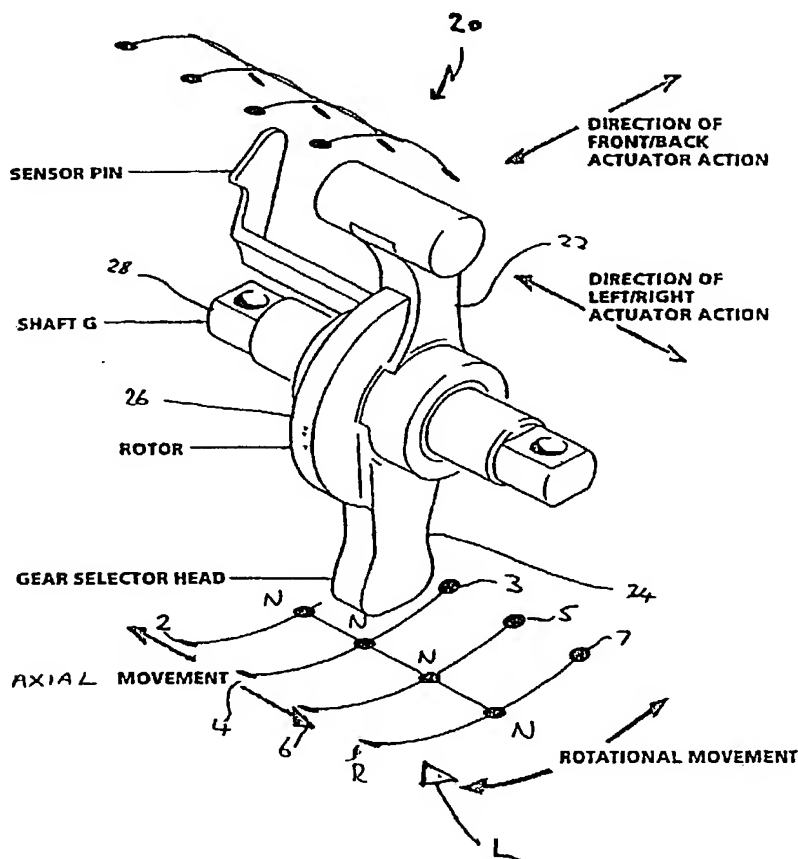
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(81) Designated States (*national*): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZW.

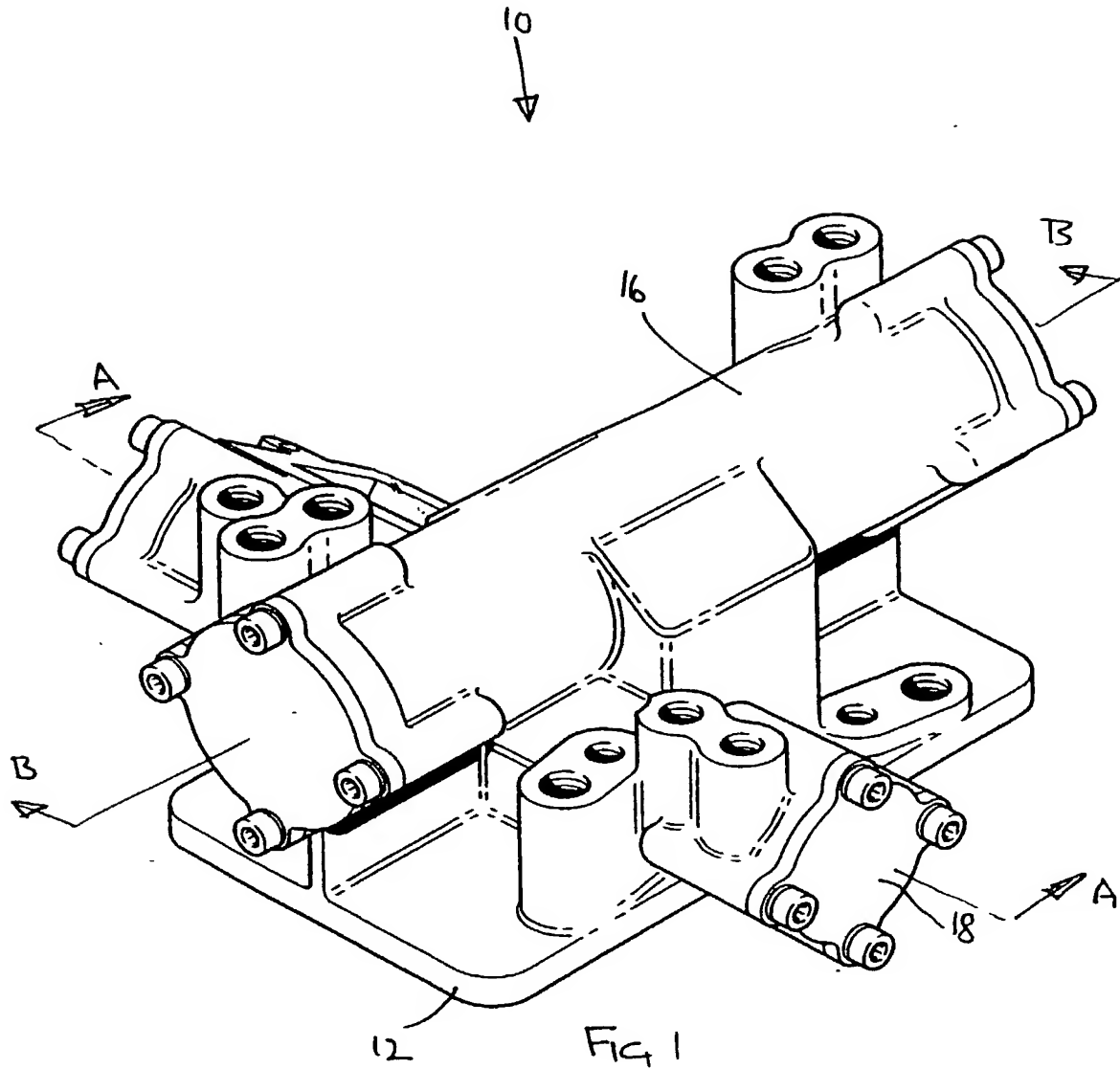
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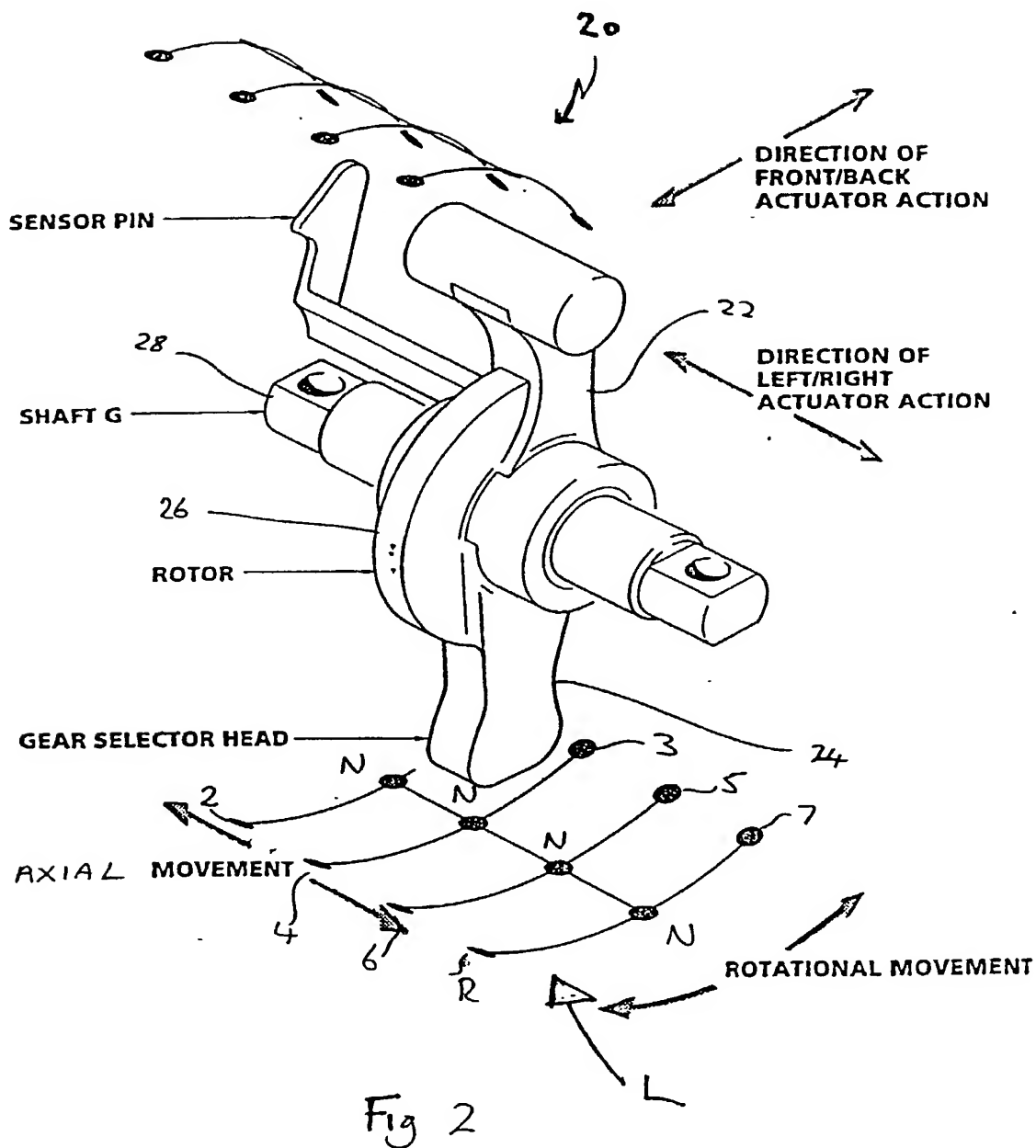
(54) Title: GEAR BOX MECHANISM



(57) Abstract: A gear change mechanism is provided which is intended for a gearbox in which changes of the gear ratio in the gearbox are made mechanically in response to actuating signals. The mechanical movements required are as for a conventional gearbox having a H type pattern. A gearbox selector (20) is mounted for movement about an axis and in the direction of the axis. The selector is operable by two actuators (16 and 18), one (16) to move the selector about its axis and the other (18) to move it in the axial direction. Each actuator can be similar having a cylinder and a shaft and annular pistons located about the shaft. For the rotational movement of the selector three positions are required, a neutral, a gear engaged position in one direction and a gear engaged position in the other direction. For movements in the direction of the axis two, three or four positions are required depending upon whether it is a two, three or four rail gearbox. An actuator is proposed which is capable of three, four, or more, positions of movement.

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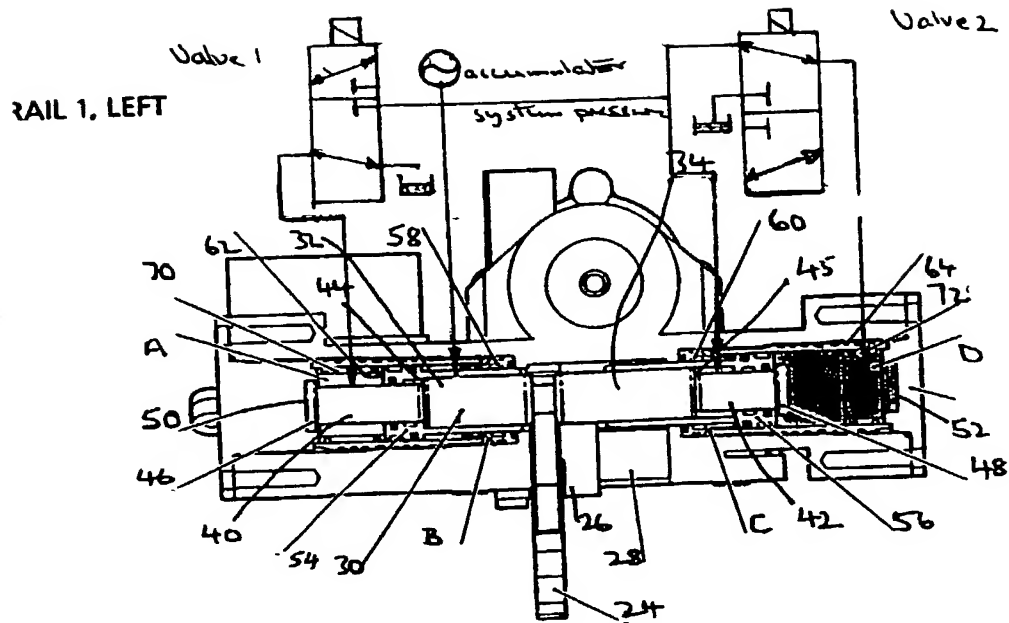


Fig 3

RAIL 4, RIGHT

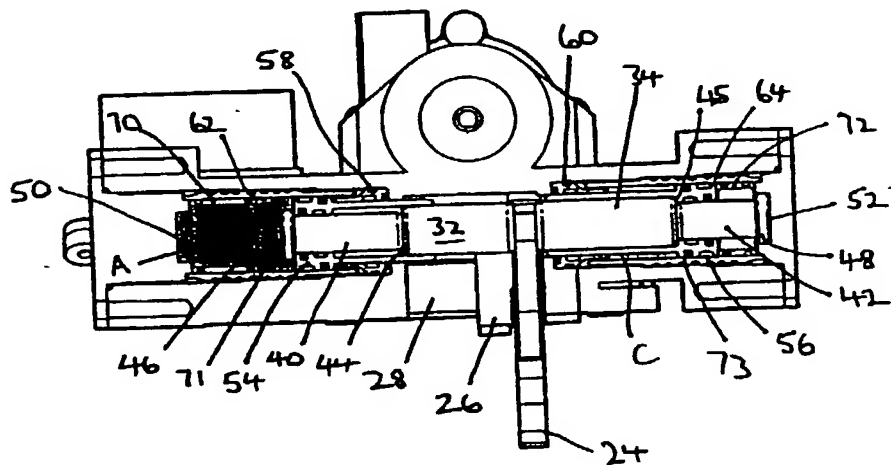
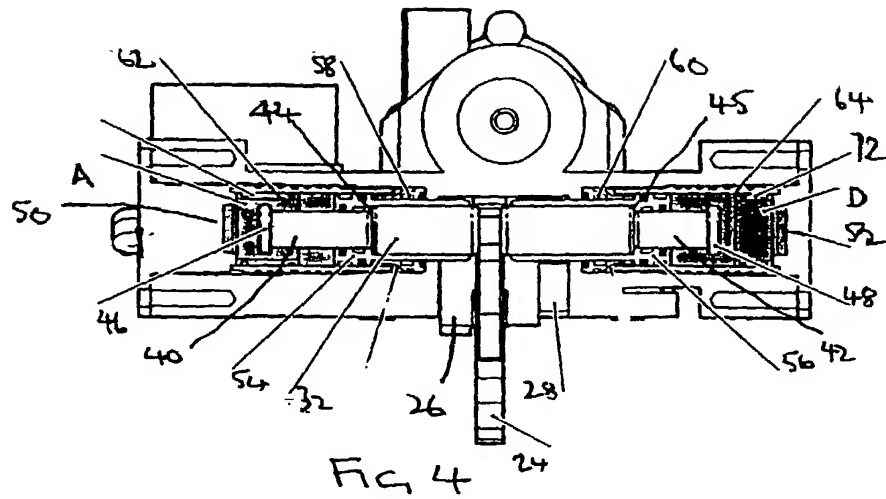


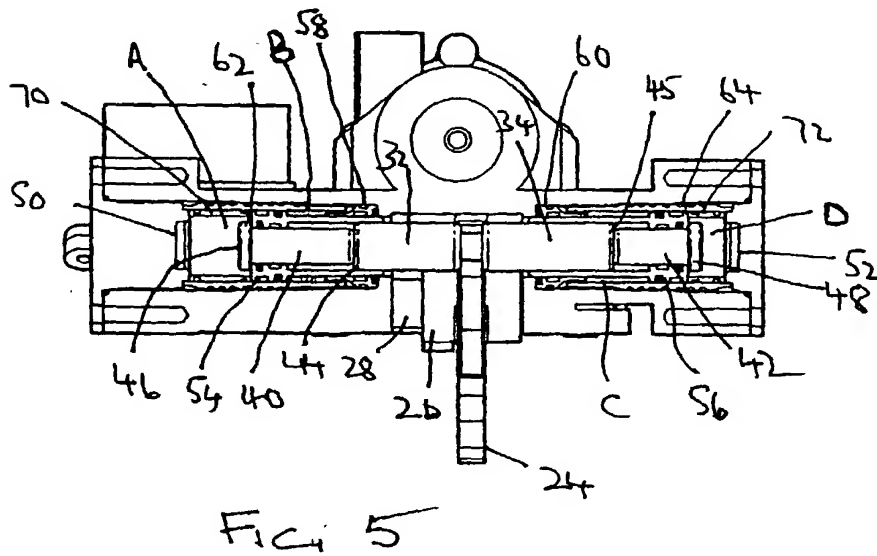
FIG 6

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RAIL 2, MIDDLE LEFT



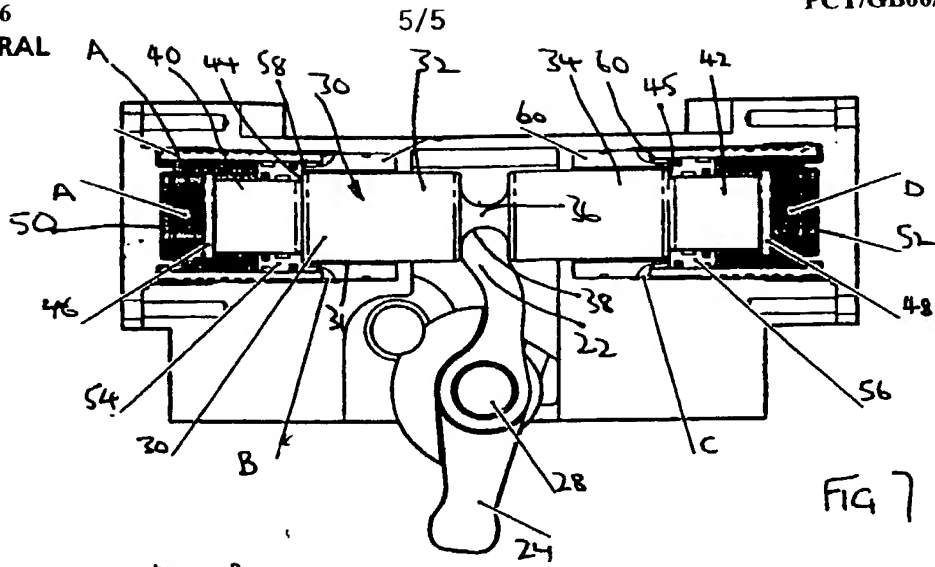
RAIL 3, MIDDLE RIGHT



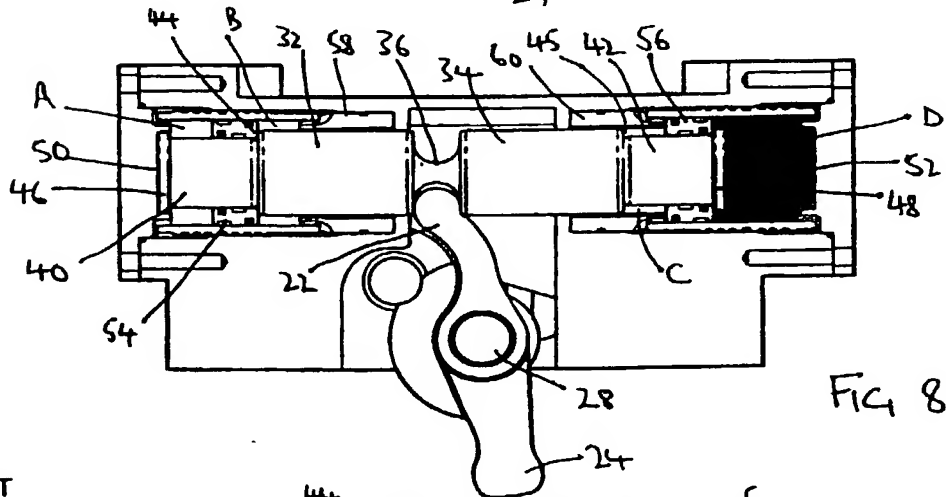
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CENTRAL



LEFT



RIGHT

